Stoller
Hanford Office

DOE-EM/GJ906-2005

# 299-W15-55 (A7356)
## Log Data Report

## Borehole Information:

| **Borehole:** | 299-W15-55 (A7356) | | **Site:** | 216-Z-5 Crib | |
|---|---|---|---|---|---|
| **Coordinates** (WA State Plane) | | **GWL (ft)[1]:** | None | **GWL Date:** | 05/23/05 |
| **North** | **East** | **Drill Date** | **TOC[2] Elevation** | **Total Depth (ft)** | **Type** |
| 135925.813 | 566549.617 | 04/47 | 678.03 | 152 | Cable |

## Casing Information:

| Casing Type | Stickup (ft) | Outer Diameter (in.) | Inside Diameter (in.) | Thickness (in.) | Top (ft) | Bottom (ft) |
|---|---|---|---|---|---|---|
| Welded steel | 0.9 | 8 5/8 | 8 | 5/16 | 0.9 | 152 |

## Borehole Notes:

The logging engineer used a caliper to determine the outside casing diameter. A steel tape was used to measure the casing stickup, caliper, and inside diameter. All measurements were rounded to the nearest 1/16 in.

## Logging Equipment Information:

| **Logging System:** | Gamma 1E | | **Type:** | SGLS (70%) 34TP40587A |
|---|---|---|---|---|
| **Eff. Calibration Date:** | 03/04/05 | **Calibration Reference:** | DOE-EM/GJ864-2005 | |
| | | **Logging Procedure:** | MAC-HGLP 1.6.5, Rev. 0 | |

| **Logging System:** | Gamma 4I | | **Type:** | Passive Neutron U1754 |
|---|---|---|---|---|
| **Calibration Date:** | None | **Calibration Reference:** | None | |
| | | **Logging Procedure:** | MAC-HGLP 1.6.5, Rev. 0 | |

## Spectral Gamma Logging System (SGLS) Log Run Information:

| **Log Run** | **1** | **2** | **3 - Repeat** | | |
|---|---|---|---|---|---|
| Date | 05/23/05 | 05/24/05 | 05/24/05 | | |
| Logging Engineer | Spatz | Spatz | Spatz | | |
| Start Depth (ft) | 60.0 | 152.0 | 60.0 | | |
| Finish Depth (ft) | 1.0 | 61.0 | 45.0 | | |
| Count Time (sec) | 100 | 100 | 100 | | |
| Live/Real | R | R | R | | |
| Shield (Y/N) | N | N | N | | |
| MSA Interval (ft) | 1.0 | 1.0 | 1.0 | | |
| ft/min | N/A[3] | N/A | N/A | | |
| Pre-Verification | AE066CAB | AE068CAB | AE068CAB | | |

| Log Run | 1 | 2 | 3 - Repeat | | |
|---|---|---|---|---|---|
| Start File | AE067000 | AE068000 | AE068092 | | |
| Finish File | AE067059 | AE068091 | AE068107 | | |
| Post-Verification | AE067CAA | AE069CAA | AE069CAA | | |
| Depth Return Error (in.) | 0 | N/A | 0 | | |
| Comments | No fine-gain adjustment. | No fine-gain adjustment. | No fine-gain adjustment. | | |

## Passive Neutron Logging System (PNLS) Log Run Information:

| Log Run | 4 | 5 | 6 Repeat | | |
|---|---|---|---|---|---|
| Date | 06/06/05 | 06/07/05 | 06/07/05 | | |
| Logging Engineer | Spatz | Spatz | Spatz | | |
| Start Depth (ft) | 60.0 | 152.0 | 60.0 | | |
| Finish Depth (ft) | 2.0 | 61.0 | 44.0 | | |
| Count Time (sec) | N/A | N/A | N/A | | |
| Live/Real | R | R | R | | |
| Shield (Y/N) | N | N | N | | |
| Sample Interval (ft) | 1.0 | 1.0 | 1.0 | | |
| ft/min | 1.0 | 1.0 | 1.0 | | |
| Pre-Verification | DI122CAB | DI132CAB | DI132CAB | | |
| Start File | DI122000 | DI132000 | DI132092 | | |
| Finish File | DI122058 | DI132091 | DI132108 | | |
| Post-Verification | DI122CAA | DI132CAA | DI132CAA | | |
| Depth Return Error (in.) | 0 | N/A | - 1 | | |
| Comments | None | None | None | | |

## Logging Operation Notes:

Pre- and post-survey verification measurements for the SGLS were acquired using the Amersham KUT ($^{40}$K, $^{238}$U, and $^{232}$Th) verifier with serial number 118. A centralizer was installed on the sondes.

Passive neutron logging was also performed in the borehole. This logging method has been shown to be effective in qualitatively detecting zones of alpha-emitting contaminants from secondary neutron flux generated by the ($\alpha$,n) reaction and may indicate the presence of transuranic radionuclides.

## Analysis Notes:

| Analyst: | Henwood | Date: | 06/08/05 | Reference: | GJO-HGLP 1.6.3, Rev. 0 |
|---|---|---|---|---|---|

SGLS pre-run and post-run verification spectra were collected at the beginning and end of each day of logging. All of the SGLS verification spectra were within the acceptance criteria. Examination of data indicates that the detectors functioned normally during logging, and the data are accepted.

Verification spectra using an AmBe neutron source were acquired for the passive neutron logging system. Currently there are no verification criteria established for this system. The counts obtained from the pre and post verifications were within 1 percent.

Log spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Verification spectra were used to determine the energy and resolution calibration for processing the data using APTEC SUPERVISOR. Concentrations were calculated in

EXCEL (source file: G1EMar05.xls). The casing configuration was assumed as one string of 8 5/8-in. outer diameter (OD) casing with a thickness of 5/16 in. to total depth (152 ft). Dead time corrections were applied to the data where the dead time exceeded 11.4 percent.. A correction for water was not required.

## Log Plot Notes:

Separate log plots are provided for man-made radionuclides, naturally occurring radionuclides ($^{40}$K, $^{238}$U, and $^{232}$Th), total gamma and dead time, and total gamma and passive neutron. Plots of the repeat logs versus the original logs are included. For each radionuclide, the energy value of the spectral peak used for quantification is indicated. Unless otherwise noted, all radionuclides are plotted in picocuries per gram (pCi/g). The open circles indicate the minimum detectable level (MDL) for each radionuclide. Error bars on each plot represent error associated with counting statistics only and do not include errors associated with the inverse efficiency function, dead time correction, or casing correction. These errors are discussed in the calibration report. A combination plot is also included to facilitate correlation. The $^{214}$Bi peak at 1764 keV is used to determine the naturally occurring $^{238}$U concentrations on the combination plot rather than the $^{214}$Bi peak at 609 keV because it exhibited slightly higher net counts per second.

## Results and Interpretations:

$^{137}$Cs, $^{60}$Co, and $^{154}$Eu were the man-made radionuclides detected in this borehole. $^{137}$Cs was detected near the ground surface and between 34 and 75 ft at a maximum concentration of approximately 11 pCi/g at 58 ft. It was also detected at a few sporadic depth intervals throughout the borehole near its MDL of approximately 0.2 pCi/g.

$^{60}$Co was detected almost continuously between 44 and 80 ft and at approximately 118 ft. A maximum concentration of 0.3 pCi/g was detected at 59 ft.

$^{154}$Eu was detected from 39 to 88 ft and at few locations between 88 and 150 ft. The maximum $^{154}$Eu concentration was approximately 4 pCi/g at 58 ft.

The passive neutron detector indicated no significant neutron flux. Slight elevation in count rate (0.7 cps) was observed near the ground surface but is not believed to be related to alpha-emitting contaminants.

The $^{40}$K and $^{232}$Th logs showed a general increase in concentrations at approximately 50 ft, suggesting a lithology change. Apparent $^{232}$Th concentrations were elevated by approximately 0.6 pCi/g in the interval between 116 and 122 ft, and this increase corresponds with fine-grained sediment of the Cold Creek Interval (formerly known as the Early Palouse Soil). The relatively low $^{40}$K and $^{232}$Th values in the interval between 124 and 134 as well as the relatively high $^{238}$U values are characteristic of the carbonate palesols of the Cold Creek Interval.

The plots of the repeat logs demonstrate reasonable repeatability of the SGLS data for the natural and man-made radionuclides and the passive neutron.

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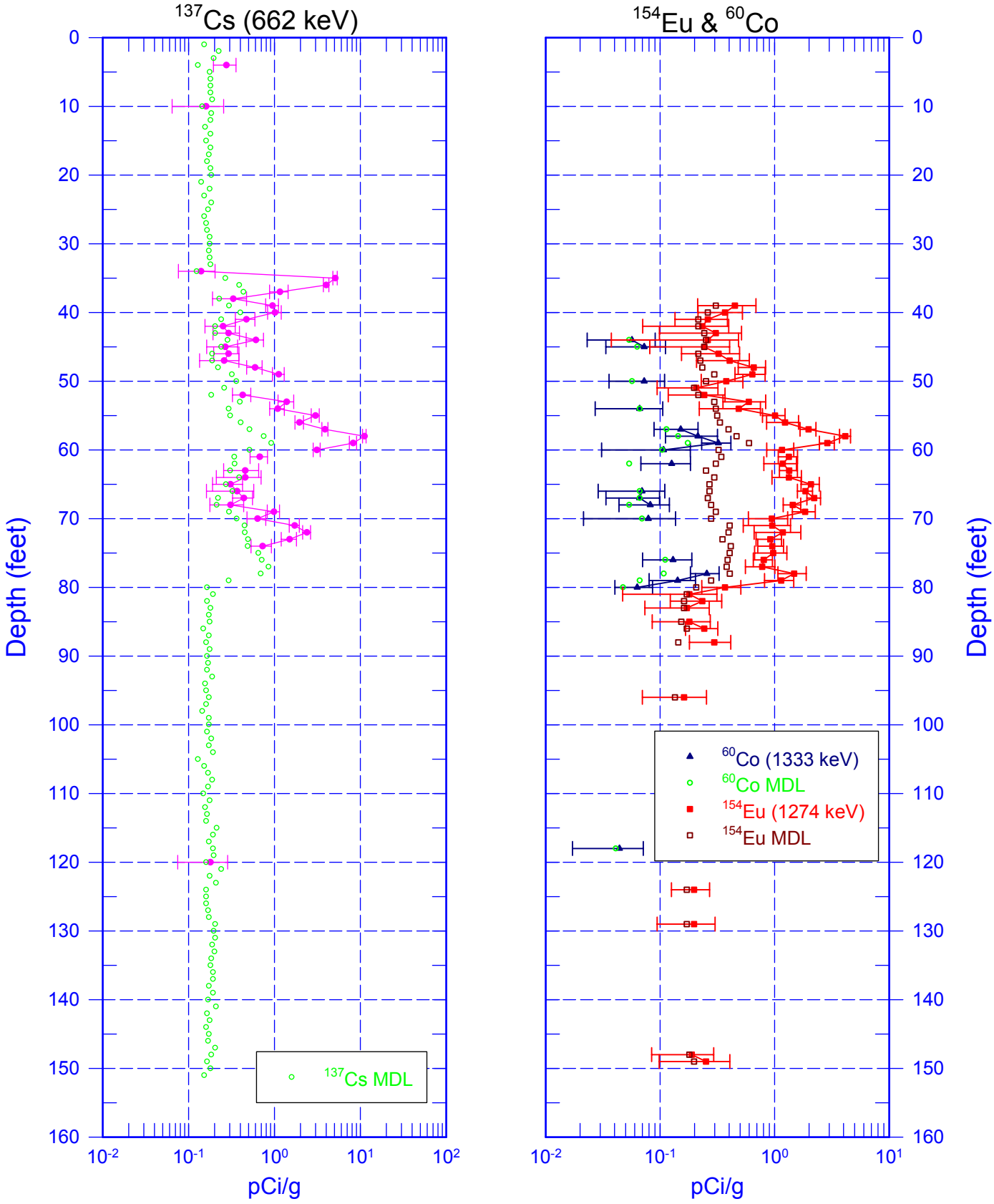
[1] GWL – groundwater level
[2] TOC – top of casing
[3] N/A – not applicable

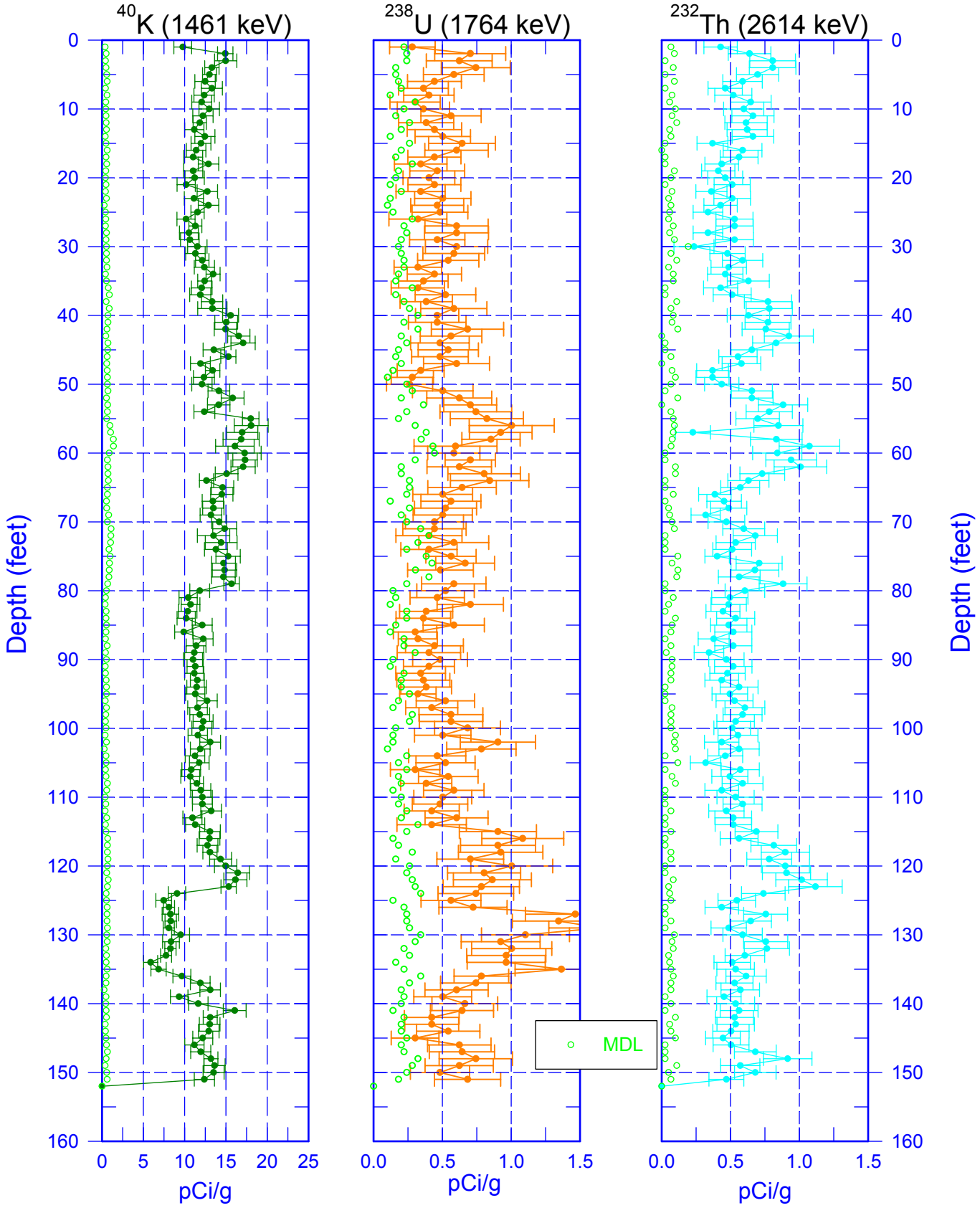
# 299-W15-55 (A7356)
## Man-Made Radionuclides




Zero Reference = Top of Casing

Last Log Date - 06/07/05

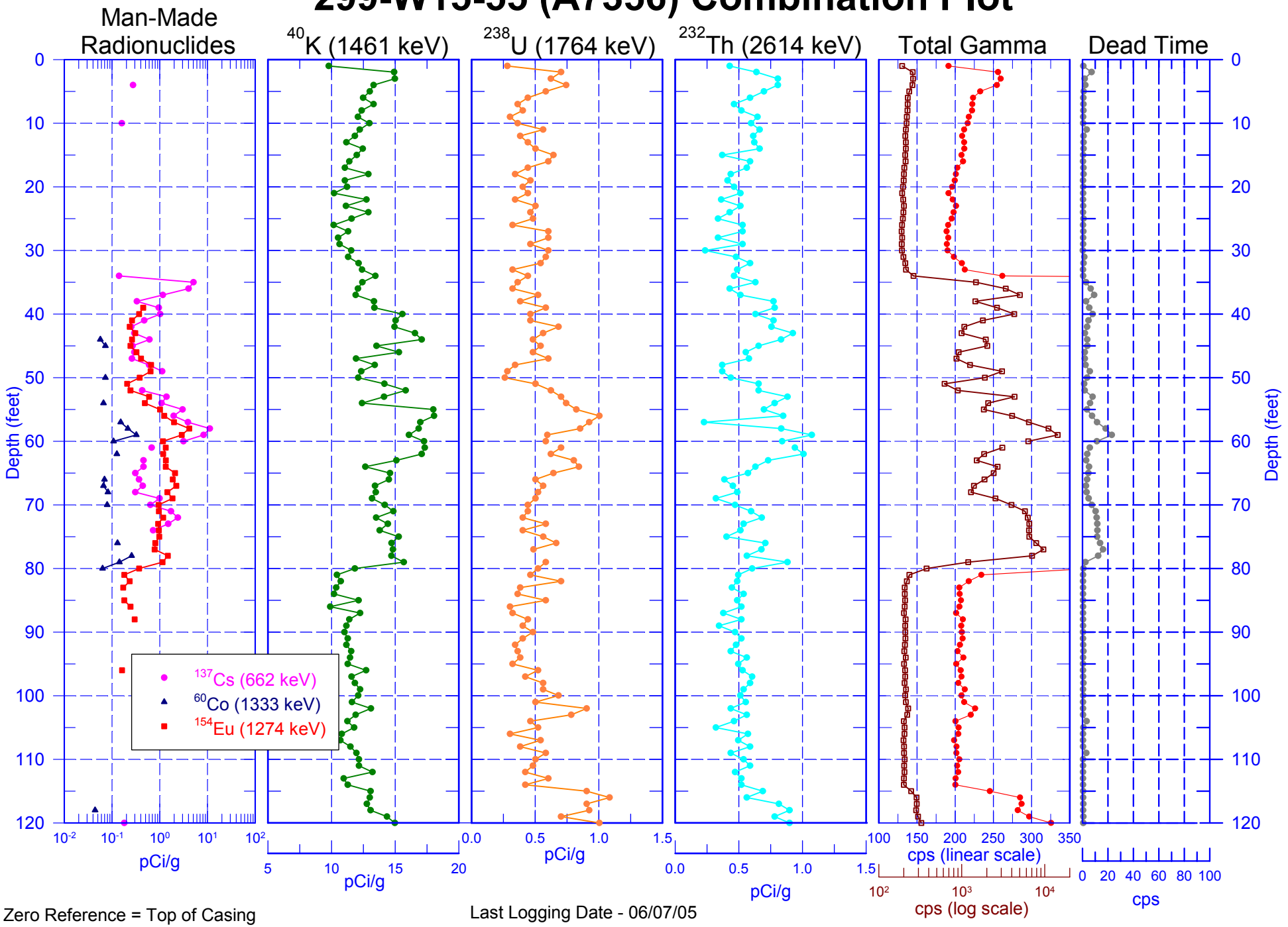
# 299-W15-55 (A7356)
## Natural Gamma Logs




Zero Reference = Top of Casing

Last Log Date - 06/07/05

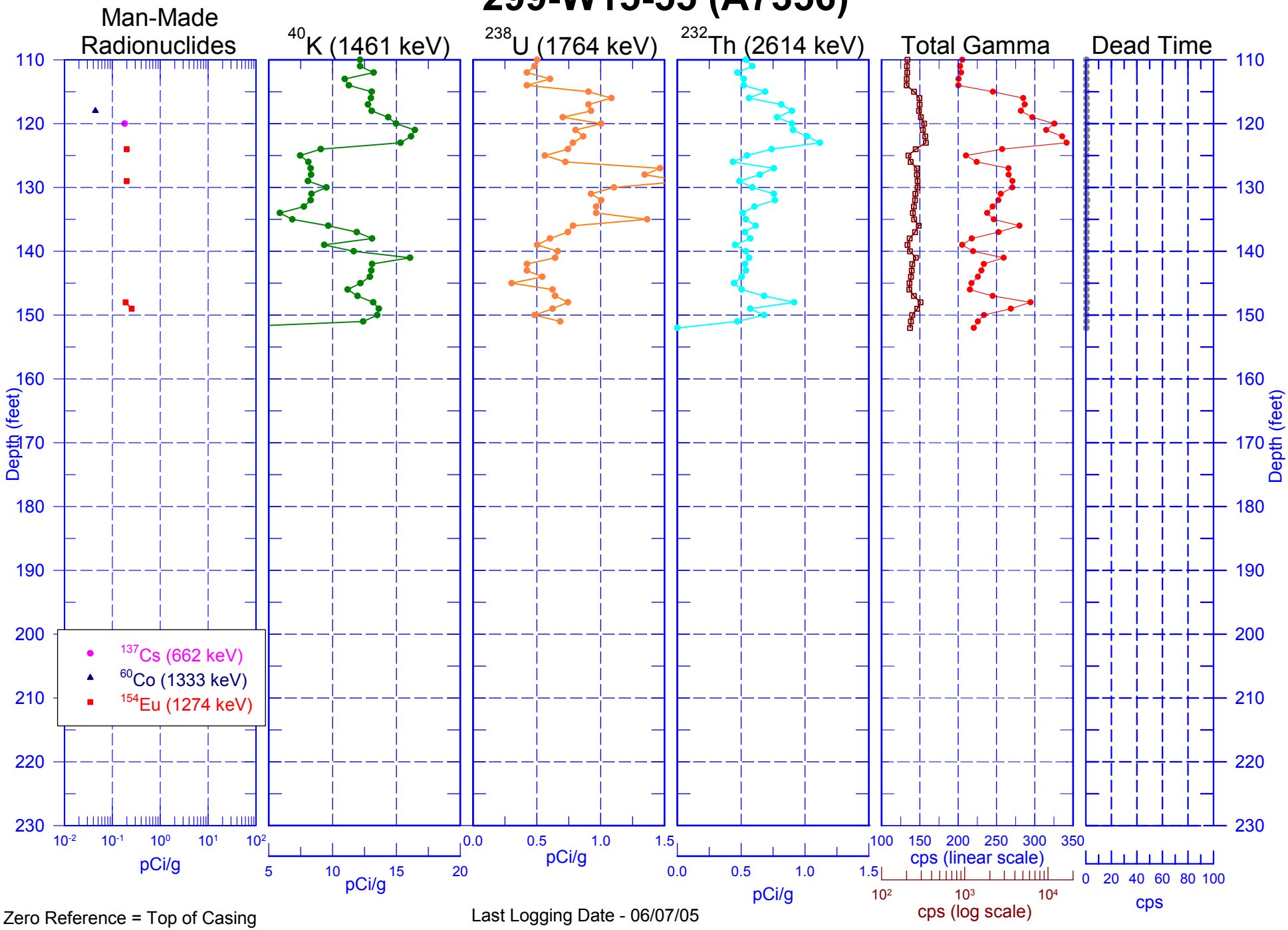
# 299-W15-55 (A7356) Combination Plot




Zero Reference = Top of Casing

Last Logging Date - 06/07/05

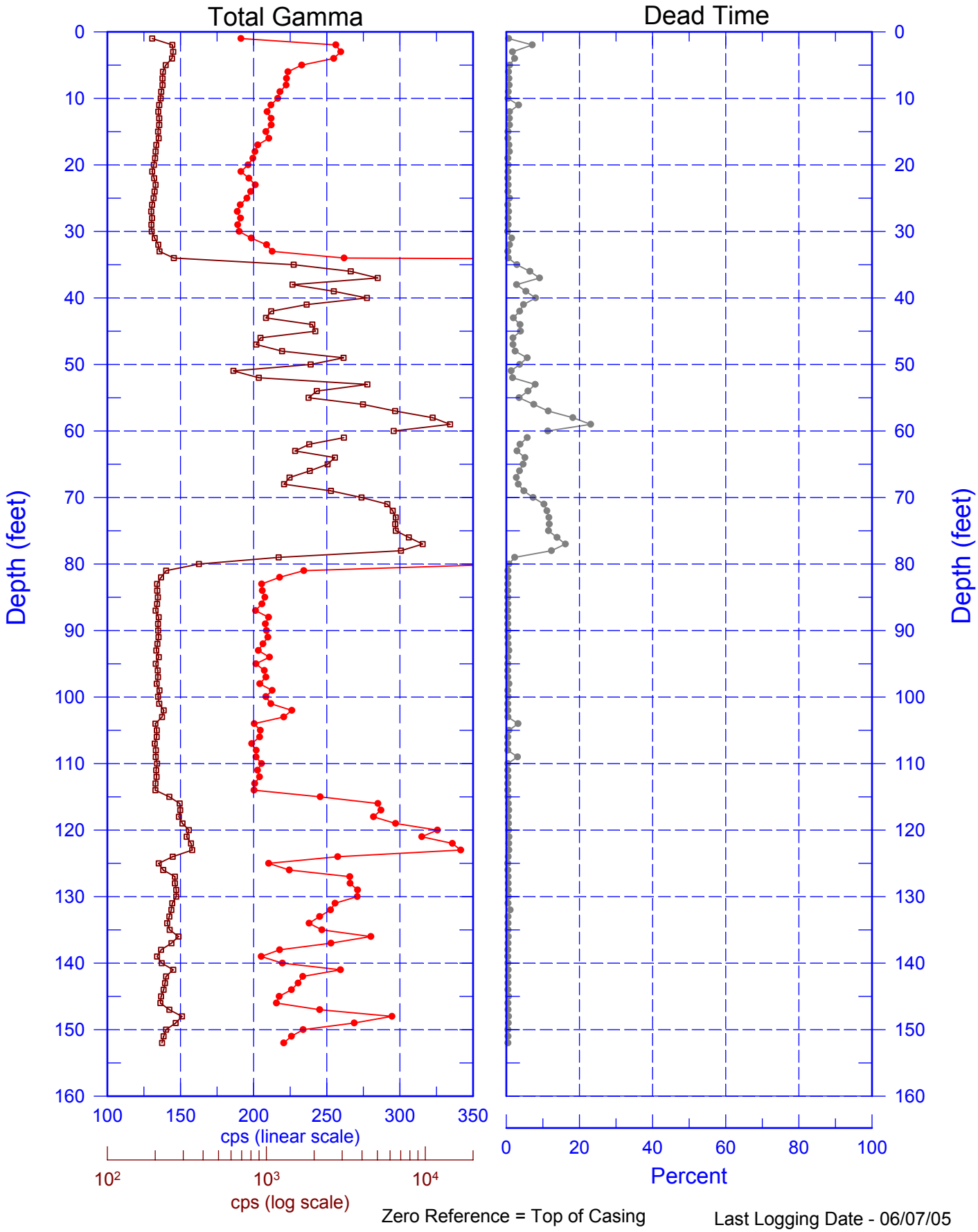
# 299-W15-55 (A7356)




Zero Reference = Top of Casing

Last Logging Date - 06/07/05

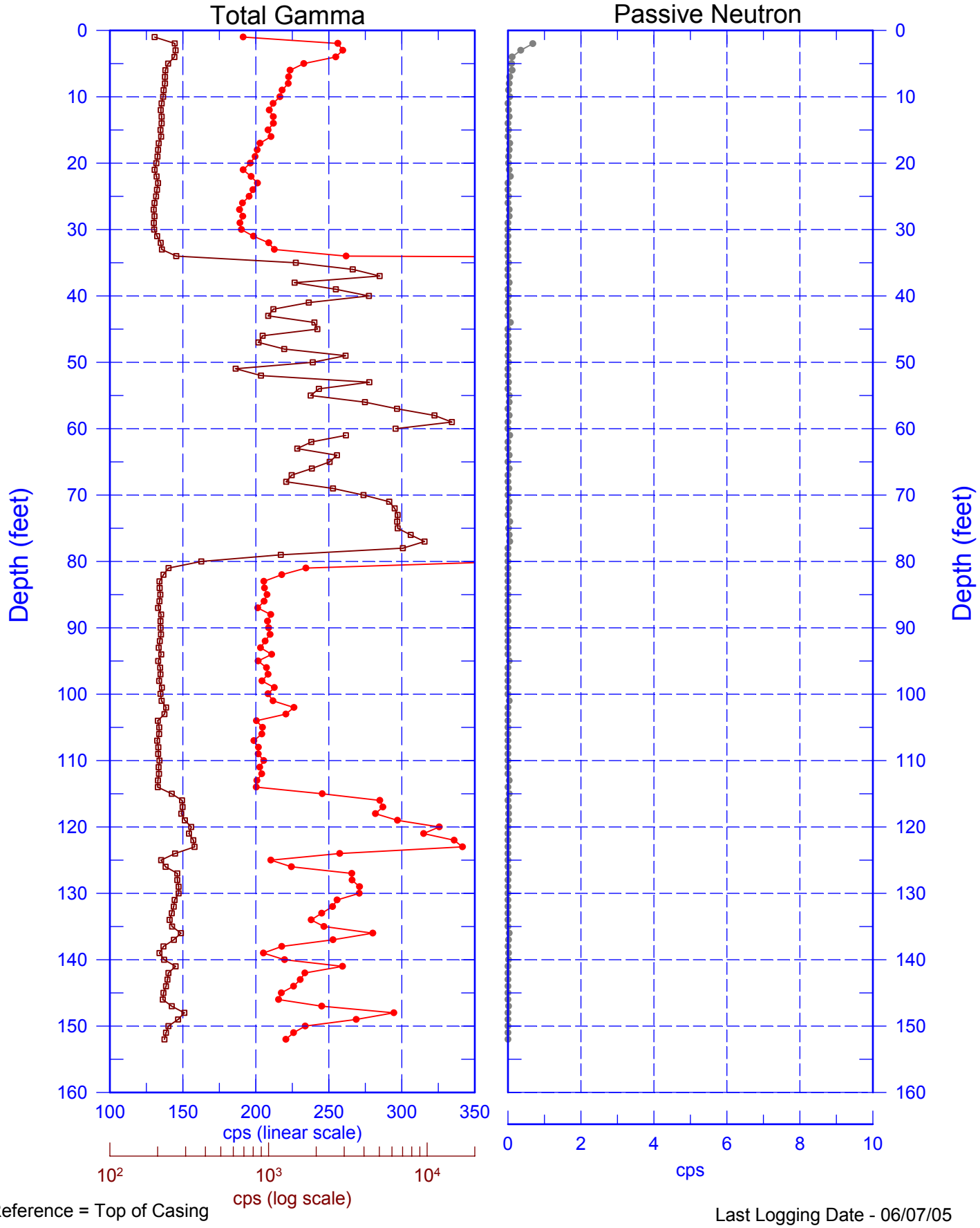
# 299-W15-55 (A7356)
# Total Gamma & Dead Time




Zero Reference = Top of Casing

Last Logging Date - 06/07/05

# 299-W15-55 (A7356)
## Total Gamma & Passive Neutron

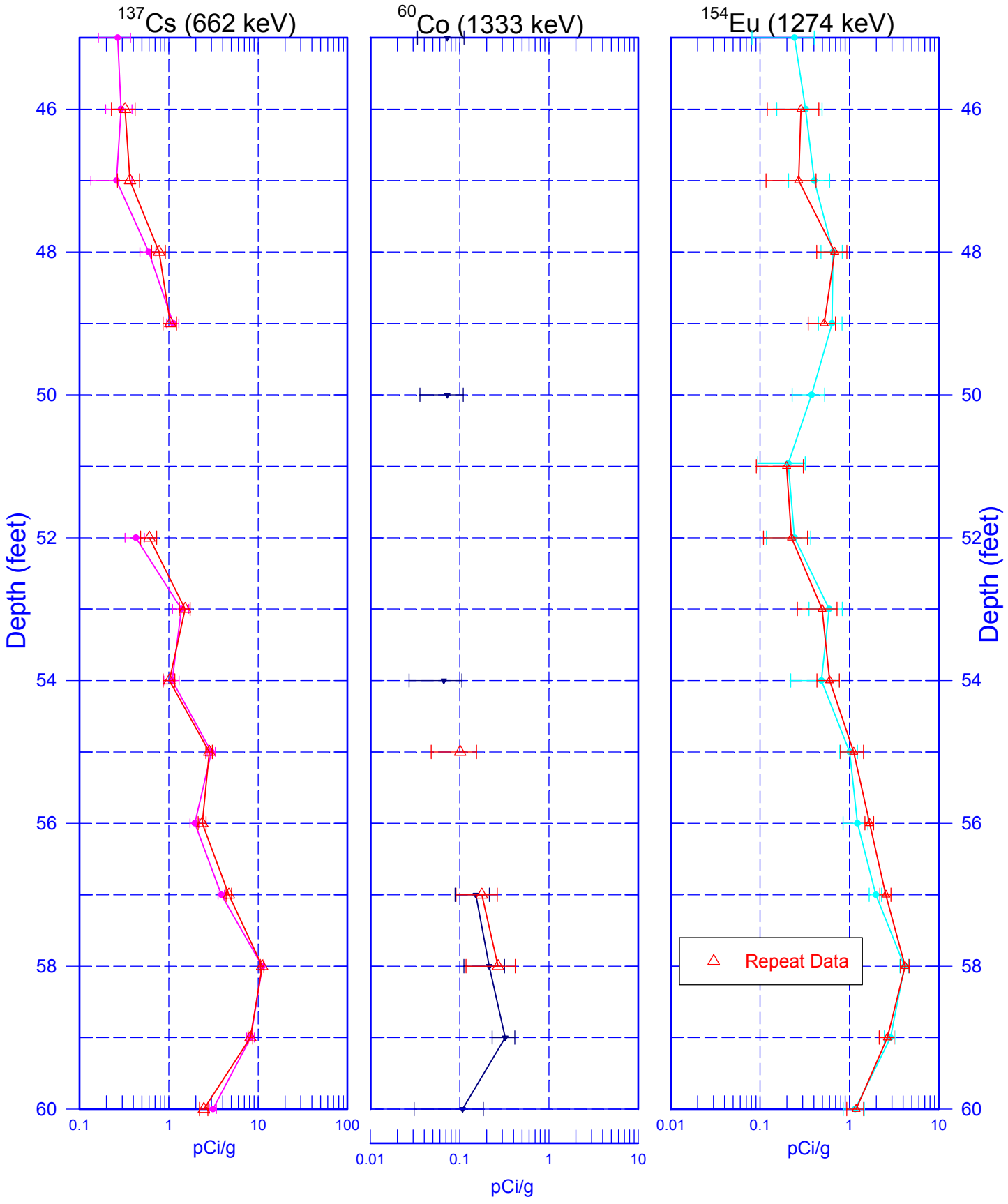



Zero Reference = Top of Casing

Last Logging Date - 06/07/05

# 299-W15-55 (A7356)

## Repeat Section of Man-made Radionuclides

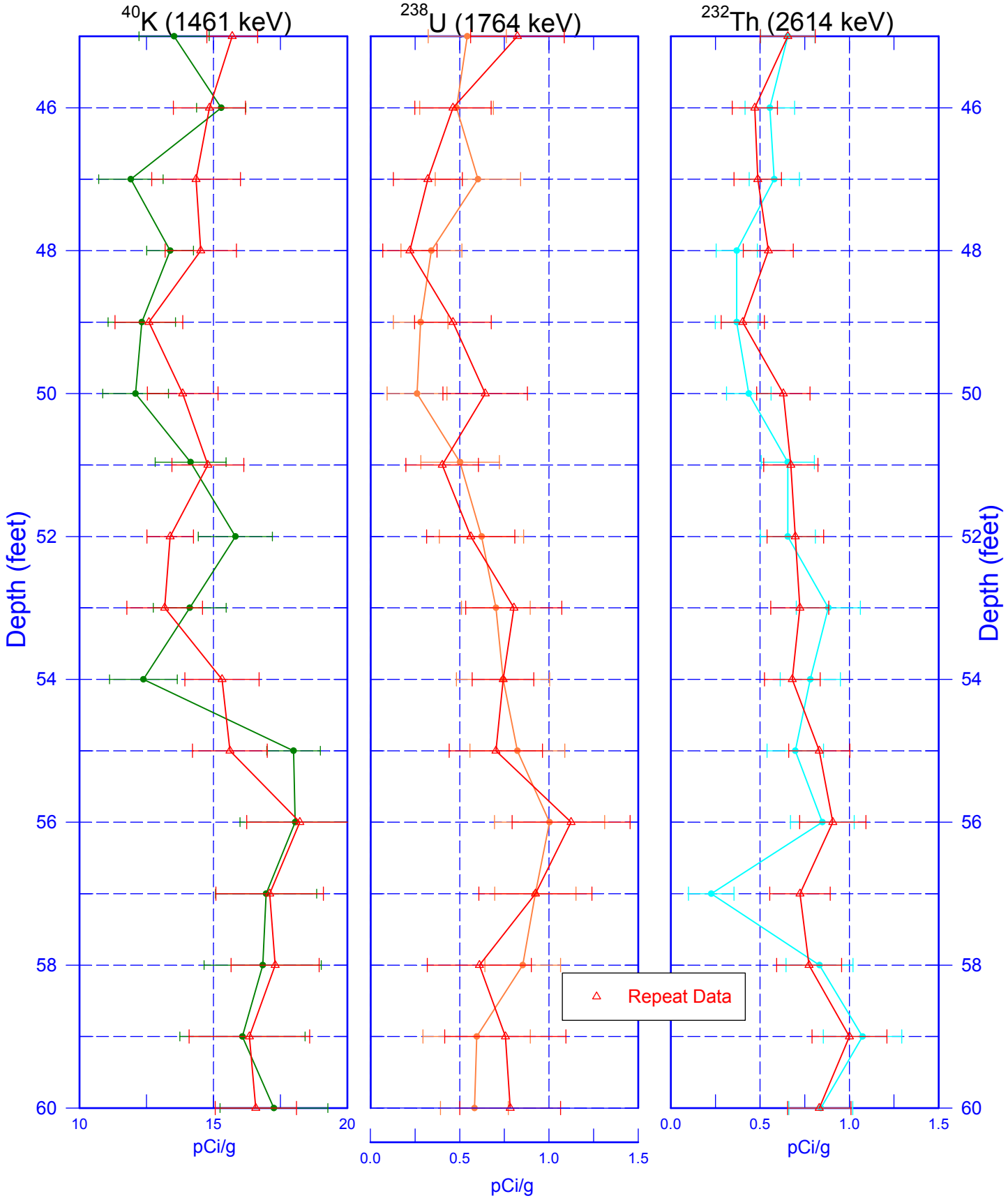



Zero Reference = Top of Casing

Last Log Date - 06/07/05

# 299-W15-55 (A7356)

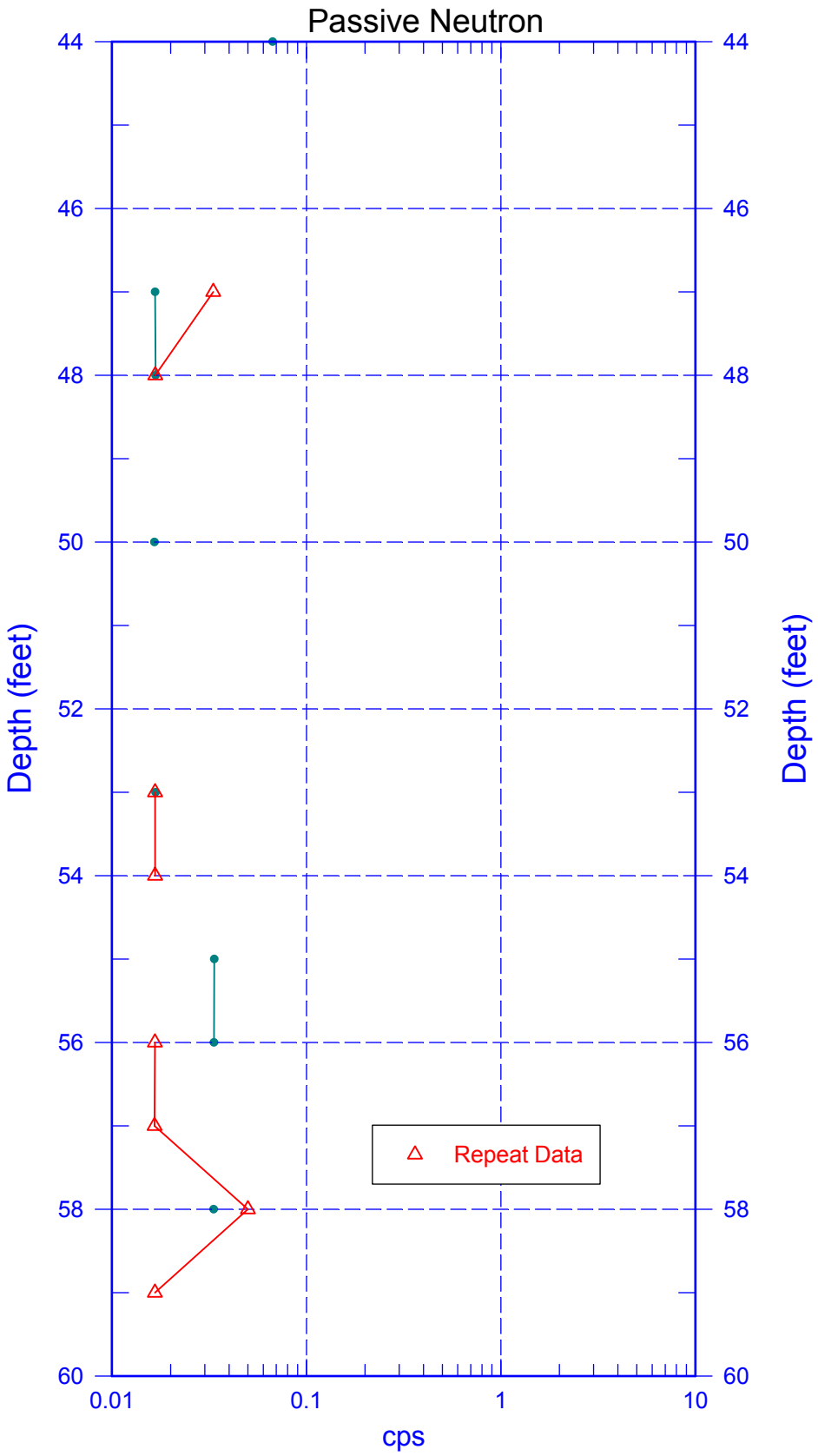
## Repeat Section of Natural Gamma Logs




Zero Reference = Top of Casing

Last Log Date - 06/07/05

# 299-W15-55 (A7356)
## Repeat Section for Passive Neutron




Zero Reference = Top of Casing

Last Logging Date - 06/07/05